

Listing of Claims

Claim 1 (Currently Amended): A method of blending a plurality of components to produce a product having a plurality of target properties, each of said plurality of components impacting one or more of said plurality of target properties and at least some of said plurality of target ~~properties~~ property being impacted by multiple components when blended, said method comprising:

receiving in a digital processing system data indicating said plurality of target properties, the manner in which each of said plurality of components impacts any of said plurality of target properties, an aggregate volume of said product to be produced and whether a first component is available from start of said blending, said received data also indicating a time instance at which said first component is available, said time instance being after a substantial continuous duration from start of said blending;

if all of said plurality of components, including said first component, are available at said start of said blending, computing component volumes of said plurality of components that would produce said product with said plurality of target properties and performing said blending to produce said product whereby said first component is also used from start of blending;

if said first component is not available at said start of said blending:

determining in said digital processing system an intermediate blend point at or after said time instance such that a corresponding intermediate properties combination can be attained at said intermediate blend point by blending only the available ones of said plurality of components from said start of said blending and said plurality of target properties can be attained by further blending said plurality of components including said first component from said intermediate blend point which would produce said aggregate volume of said product; and

controlling flow rates of each of said plurality of components to attain said intermediate properties combination at said intermediate blend point, and to attain said plurality of target properties from said intermediate properties combination after said intermediate blend point, whereby said product of said aggregate volume is generated by blending said plurality of components,

wherein said determining comprises:

computing using said digital processing system a plurality of ideal volumes corresponding to said plurality of components which would be blended if said first component were to be available during entire blend duration, wherein said plurality of ideal volumes includes a first ideal volume for said first component;

assigning said first ideal volume to a temporary variable;

searching whether one or more of said intermediate blend points are feasible with said temporary variable as volume for said first component;

if one or more of said intermediate blend points are feasible, said controlling using one of said one or more intermediate blend points to control the flow rates of said plurality of components; and

if any of said intermediate blend points is not feasible, decreasing said temporary variable by an amount and performing said searching.

Claim 2 (Original): The method of claim 1, wherein said determining determines said intermediate blend point to meet a desired criteria.

Claim 3 (Original): The method of claim 2, wherein said desired criteria comprises minimizing total cost of said plurality of components blended to produce said product.

Claim 4 (Previously Presented): The method of claim 1, wherein each of said plurality of components are provided for blending by a corresponding plurality of outlets, wherein each of a plurality of source controllers control the flow rate of a corresponding one of said plurality of outlets, said method further comprises:

determining in said digital processing system each of a first plurality flow rates for a corresponding one of each of said plurality of components before said intermediate blend point such that said intermediate properties combination is attained for said product at said intermediate blend point;

determining in said digital processing system each of a second plurality flow rates for a corresponding one of each of said plurality of components after said intermediate blend point such that said plurality of target properties are attained for said product after said intermediate blend point,

wherein said controlling is performed by operating said plurality of outlets according to said first plurality of flow rates before said intermediate blend point and said second plurality of flow rates after said intermediate blend point.

Claim 5 (Canceled)

Claim 6 (Currently Amended): The method of claim 15, wherein said searching finds said one or more intermediate blend points consistent with a plurality of constraints posed by a manufacturing plant.

Claim 7 (Original): The method of claim 1, wherein said method is performed in an oil refinery.

Claim 8 (Currently Amended): A computer readable medium storing ~~carrying~~ one or more sequences of instructions for causing a computer system to support blending of a plurality of components to produce a product having a plurality of target properties, each of said plurality of components affecting one or more of said plurality of target properties and at least some of said plurality of target properties being impacted by multiple components when blended, a first component being scheduled to be available for said blending only at a time instance which is after a substantial continuous duration from start of said blending, wherein said first component is comprised in said plurality of components and is designed to enhance a first set of properties comprised in said plurality of target properties when blended, wherein execution of said one or more sequences of instructions by one or more processors contained in said computer system causes said one or more processors to perform the actions of:

receiving data indicating said plurality of target properties, the manner in which each of said plurality of components affects any of said plurality of target properties, said time instance, and an aggregate volume of said product to be produced; and

determining an intermediate blend point at or after said time instance such that a corresponding intermediate properties combination can be attained at said intermediate blend point by blending only the available ones of said plurality of components and said plurality of target properties can be attained by further blending said plurality of components including said first component from said intermediate blend point which would produce said aggregate volume of said product,

wherein flow rates of each of said plurality of components are controlled to attain said intermediate properties combination at said intermediate blend point, and to attain said plurality of target properties from said intermediate properties combination after said intermediate blend point, whereby said product of said aggregate volume is generated by blending said plurality of components,

wherein said available ones of said plurality of components include a second set of components which when blended enhance said first set of properties,

at least some of said second set of components being blended by a higher volume up to said intermediate blend point compared to if said first component were to be available from the start of said blending,

wherein said determining comprises:

computing a plurality of ideal volumes corresponding to said plurality of components which would be blended if said first component were to be available during entire blend duration, wherein said plurality of ideal volumes includes a first ideal volume for said first component;

setting a temporary variable equal to said first ideal volume;

finding whether one or more of said intermediate blend points are possible with said temporary variable as volume for said first component;

if one or more of said intermediate blend points are possible, using one of said one or more intermediate blend points to control the flow rates of said plurality of components; and

if one or more of said intermediate blend points are not possible, decreasing said temporary variable by an amount and performing said finding.

Claim 9 (Original): The computer readable medium of claim 8, wherein said determining determines said intermediate blend point to meet a desired criteria.

Claim 10 (Original): The computer readable medium of claim 9, wherein said desired criteria comprises minimizing total cost of said plurality of components blended to produce said product.

Claim 11 (Previously Presented): The computer readable medium of claim 8, wherein each of said plurality of components are provided for blending by a corresponding plurality of

outlets, wherein each of a plurality of source controllers control the flow rate of a corresponding one of said plurality of outlets, further comprises:

determining in said computer system each of a first plurality flow rates for a corresponding one of each of said plurality of components before said intermediate blend point such that said intermediate properties combination is attained for said product at said intermediate blend point;

determining in said computer system each of a second plurality flow rates for a corresponding one of each of said plurality of components after said intermediate blend point such that said plurality of target properties are attained for said product after said intermediate blend point,

wherein said controlling is performed by operating said plurality of outlets according to said first plurality of flow rates before said intermediate blend point and said second plurality of flow rates after said intermediate blend point.

Claim 12 (Canceled)

Claim 13 (Currently Amended): The computer readable medium of claim ~~8~~¹², wherein said finding finds said one or more intermediate blend points consistent with a plurality of constraints posed by a manufacturing plant.

Claim 14 (Currently Amended): A manufacturing plant for blending a plurality of components to produce a product having a plurality of target properties, each of said plurality of components affecting one or more of said plurality of target properties and at least some of said plurality of target properties ~~property~~ being impacted by multiple components when blended, a first component being scheduled to be available for said blending in said manufacturing plant only at a time instance which is after a substantial continuous duration from start of said blending, wherein said first component is comprised in said plurality of components and is designed to enhance a first set of properties comprised in said plurality of target properties when blended, said manufacturing plant comprising:

a blender;

a plurality of outlets, wherein each of said plurality of outlets provides a corresponding one of said plurality of components according to a corresponding flow rate for blending by said blender;

a plurality of source controllers, wherein each of said plurality of source controllers controls the flow rate of a corresponding one of said plurality of outlets; and

a blend controller determining the flow rate for each of said plurality of source controllers, said blend controller is operable to:

receive data indicating said plurality of target properties, the manner in which each of said plurality of components affects any of said plurality of target properties, said time instance, and an aggregate volume of said product to be produced;

determine an intermediate blend point at or after said time instance such that a corresponding intermediate properties combination can be attained at said intermediate blend point by blending only the available ones of said plurality of components and said plurality of target properties can be attained by further blending said plurality of components including said first component from said intermediate blend point which would produce said aggregate volume of said product; and

control flow rates of each of said plurality of components to attain said intermediate properties combination at said intermediate blend point, and to attain said plurality of target properties from said intermediate properties combination after said intermediate blend point, whereby said product of said aggregate volume is generated by blending said plurality of components,

wherein said available ones of said plurality of components include a second set of components which when blended enhance said first set of properties,

at least some of said second set of components being blended by a higher volume up to said intermediate blend point compared to if said first component were to be available from the start of said blending,

wherein to perform said determine, said blend controller is further operable to:
compute a plurality of ideal volumes corresponding to said plurality of components which would be blended if said first component were to be available during entire blend duration, wherein said plurality of ideal volumes includes a first ideal volume for said first component;

assign said first ideal volume to a temporary variable;

search whether one or more of said intermediate blend points are feasible with said temporary variable as volume for said first component;

if one or more of said intermediate blend points are feasible, said control using one of said one or more intermediate blend points to control the flow rates of said plurality of components; and

if any of said intermediate blend points is not feasible, decreasing said temporary variable by an amount and performing said search.

Claim 15 (Previously Presented): The manufacturing plant of claim 14, wherein said intermediate blend point is determined to meet a desired criteria.

Claim 16 (Previously Presented): The manufacturing plant of claim 15, wherein said desired criteria comprises minimizing total cost of said plurality of components blended to produce said product.

Claim 17 (Currently Amended): The manufacturing plant of claim 14, wherein each of said plurality of components are provided for blending by a corresponding plurality of outlets, wherein each of a plurality of source controllers controls the flow rate of a corresponding one of said plurality of outlets, said blend controller ~~digital processing system~~ is further operable to:

determine each of a first plurality flow rates for a corresponding one of each of said plurality of components before said intermediate blend point such that said intermediate properties combination is attained for said product at said intermediate blend point;

determine each of a second plurality flow rates for a corresponding one of each of said plurality of components after said intermediate blend point such that said plurality of target properties are attained for said product after said intermediate blend point,

wherein said control is performed by operating said plurality of outlets according to said first plurality of flow rates before said intermediate blend point and said second plurality of flow rates after said intermediate blend point.

Claim 18 (Canceled)

Claim 19 (Currently Amended): The method of claim 1, wherein said first component is not available at start of said blending and is designed to enhance a first set of properties comprised in said plurality of target properties when blended,

wherein said available ones of said plurality of components include a second set of components which when blended enhance said first set of properties,

at least some of said second set of components being blended by a higher volume up to said intermediate blend point compared to if said first component were to be available from the start of said blending.

Claim 20 (Currently Amended): The computer readable medium of claim 8, further comprising:

if all of said plurality of components, including said first component, are available, computing component volumes of said plurality of components that would produce said product with said plurality of target properties and performing said blending to produce said product based on said component volumes, whereby said first component is also ~~is~~ used from start of blending.